Mr. Charlene S. Fitch, P.E.
Missouri Department of Natural Resources
Solid Waste Management Program
1738 East Elm Street
Jefferson City, Missouri 65101

May 22, 2015

Expanded Heat Removal Pilot Study
Bridgeton Landfill, Bridgeton, Missouri
Permit No. 0118912

Dear Ms. Fitch:

This letter is being submitted in response to the Department of Natural Resources' Solid Waste Management Program (SWMP) letter dated April 23, 2015. This letter provided the conditional approval to retrofit five (5) additional Gas Interceptor Wells (GIW-8,-9, -11, -12 and -13) with heat removal technology. This modification is scheduled to be completed by the end of June 2015, pending weather or material procurement related delays.

The Conditional Approval from the SWMP included a request for additional information regarding the proposed expansion of the Pilot Study. The Bridgeton Landfill hereby provides the following information.

Condition 1a. A technical narrative including, a discussion of why the proposed additional GIWs are using a different design, i.e., dual pipe system, from the original heat extraction technology, why TMPs are no longer needed at consistent distances from the newly modified GIWs to document effective heat removal using the pilot system and absent new consistently spaced TMPs what other method will be used to document the effectiveness of the system.

Response 1a: Both the U-tube and dual pipe system have been utilized as part of the Heat Extraction System Pilot Study at the Bridgeton Landfill. Both methods have shown the capability of removing heat that arrives, at the respective GIW, at a rate that does not retard the heat removal process. Both systems have shown similar patterns with respect to change in temperature of the influent and effluent and flow rates within the GIW structure, relative to depth of installation.

All current TMPs within fifty (50) feet of the GIWs to be retrofit will be utilized to evaluate the effect of additional heat extraction pursuant to this expansion. The initial expansion of the pilot study, approved by SWMP, included monitoring in-waste temperatures at different offsets and depths from the heat extraction points. By expanding the system to include a second parallel row of heat removal elements, additional effects will be measured in existing TMPs. Specifically, this will provide information of the effect of offset heat extraction point rows relative to the heat gradient from the south.

Condition 1b. Within the technical narrative, a discussion of how it was determined the heat extraction technology is viable given more GIWs are being retrofitted. Also, are additional heat removal points planned for installation at the Bridgeton Landfill.

Response 1b: The in-waste temperature measurements, previously submitted to the SWMP, show heat reduction local to respective heat extraction elements. The in-waste thermocouple data also represents a distinct heat gradient at the current line of heat extraction elements. The temperatures observed on the south side of the heat extraction points are higher than temperatures measured on the north side. The in-waste temperature measurements have shown a significant temperature reduction, locally, on the north side of heat extraction elements during heat removal operations.

The Bridgeton Landfill wishes to expand the heat extraction pilot study for the purpose of gathering the data needed to support an OU-1 barrier evaluation and for the consideration of a potential line of heat extraction elements south of the OU-1 barrier.

Condition 1c. Data collection methodology and analysis methods/protocols for expanded system including any assumptions used and, at a minimum,

i. *Calculations used to determine thermal conductivity and heat storage properties of the landfill waste mass and the results of those calculations.*

ii. *Calculations used to predict the amount of heat that could be extracted under steady state conditions and the results of those calculations.*

iii. *An assessment of the heat front's progress to the north and the rate of energy flux to the north.*

Response 1c: Data collection related to heat extraction expansion components will be consistent with current measurement frequencies. This will include weekly measurements of in-waste thermocouples adjacent to the expanded elements, as is currently being measured. Near daily readings of liquid temperature and flow will be recorded at each of the GIWs retrofitted with heat extraction elements.

The intent of the heat extraction expansion to include GIW-8, -9, -11, -12 and -13 is to better understand thermal conductivity, heat storage properties, energy removal rates, energy flux and heat gradient at the Bridgeton Landfill. The results and analysis of data collected will be submitted in the initial pilot project report, to be submitted by August 4, 2015, as required by the SWMP.

Condition 1d. Provide in the technical narrative the reason the in-casing thermocouples installed at various depths in the first 7 GIWs were eliminated from this expansion of the pilot study.

Response 1d: In-casing thermocouples will be included in each of the GIWs retrofitted with heat extraction technology. The depth of in-casing thermocouples, in the respective GIWs, will be included in the as-built documentation.

Condition 1e. A drawing showing all TMPs from which information will be gathered in support of this project expansion. Specifically, information related to the 5 newly modified GIWs.

i. *The drawing must also identify the number and depth of all working thermocouples on each TMP used to report on these GIWs.*

ii. *The drawing must contain a table disclosing the distance from the each operating TMP to the closest GIW.*

Response 1e: A drawing and table including the requested information has been included as Alternative Heat Extraction Expansion Drawing No. 1 (Attachment No. 1). Based on preliminary analysis, it was estimated that all TMPs within fifty (50) feet of the proposed additional heat extraction elements would be included.

Condition 2. With submittal of the as-built drawings, a drawing that shows the liquid level in all the GIWs at the time of installation of the heat removal unit.

Response 2: The liquid level in all the GIWs at the time of installation of the heat removal units will be included in the submittal of the as-built drawings.

Condition 3. Bridgeton Landfill must continue submission of quarterly pilot study status reports as required by the SWMP's August 25, 2014, response letter.

Response 3: The Bridgeton Landfill will continue the submission of quarterly pilot study status reports as required by the SWMP.

The Bridgeton Landfill will continue compliance with the requirements set forth in the September 4, 2014, Conditional Approval of the Expanded Heat Removal Pilot Study by the SWMP.

If you need additional information, please contact me at (314) 744-8166.

Sincerely,

Brian J. Power

Brain J. Power
Environmental Manager
Bridgeton Landfill, LLC.

Attachments

Attachment No. 1 (Alternative Heat Extraction Drawing No. 1)